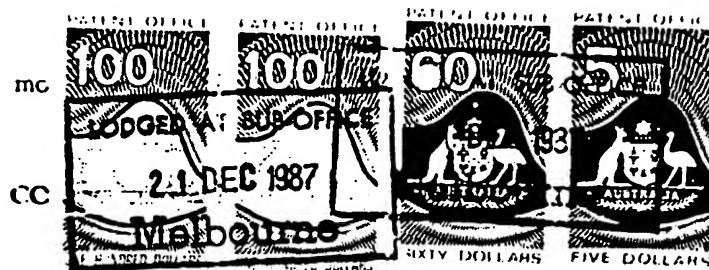


(CONVENTION. By one or more



CONVENTION APPLICATION FOR A PATENT

(1) Here
insert in
full Name
of
Name of
Applicant or
Applicants
to be used by
Address (see)

We
of HOECHST AKTIENGESELLSCHAFT,
45 Bruningstrasse, D-6230 Frankfurt/Main 80,
Federal Republic of Germany

(2) Here
insert Title
of invention

hereby apply for the grant of a Patent for an invention entitled:⁽²⁾
BICYCLIC IMIDES. A PROCESS FOR THEIR PREPARATION, AND
THEIR USE IN PLANT PROTECTION

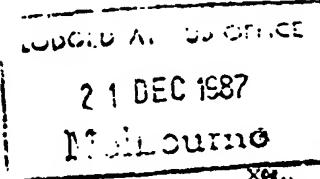
(3) Here insert
number(s)
of basic
application(s)

which is described in the accompanying complete specification. This application is a
Convention application and is based on the application numbered⁽³⁾

P36 43 748.4

(4) Here insert
Name, Class,
Country of
Priority and
Date of
Priority

for a patent or similar protection made in ⁽⁴⁾ Federal Republic of Germany
on 20th December 1986



DATED this 18th day of December 1987

HOECHST AKTIENGESELLSCHAFT

James Murray
James Murray

Registered Patent Attorney

COMMONWEALTH OF AUSTRALIA
Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION UNDER PART XVI.
FOR A PATENT.

In support of the Convention application made under Part XVI. of the Patents Act 1952 by HOECHST AKTIENGESELLSCHAFT of 45, Brüningstrasse, D-6230 Frankfurt/Main 80, Federal Republic of Germany for a patent for an invention entitled:

BICYCLIC IMIDES, A PROCESS FOR THEIR PREPARATION, AND THEIR USE IN PLANT FERTILIZERS
Bernhard Frey, Dipl.-Ing. (Chemical Engineer),
We, Franz Lippert, Dipl.-Ing. (Chemical Engineer),
Federal Republic of Germany

do solemnly and sincerely declare as follows:

1. We are authorized by HOECHST AKTIENGESELLSCHAFT the applicant for the patent to make this declaration on its behalf.
2. The basic application as defined by Section 141 of the Act was made in the Federal Republic of Germany under No. 10 21 111 111 on 11.11.1951 by HOECHST AKTIENGESELLSCHAFT

3. a) Rainer Lippert, Dipl.-Ing. (Chemical Engineer),
b) Michael Frey, Dipl.-Ing. (Chemical Engineer),
c) Helmut Mühlbacher, Dipl.-Ing. (Chemical Engineer),
d) Klaus Peters, Dipl.-Ing. (Chemical Engineer),
e) Hermann Pfeiffer, Dipl.-Ing. (Chemical Engineer),
all of HOECHST AKTIENGESELLSCHAFT, Frankfurt (Main), Federal Republic of Germany

is ~~also~~ the actual inventor(s) of the invention and the facts upon which HOECHST AKTIENGESELLSCHAFT

is entitled ~~to~~ make the application are as follows:

The said HOECHST AKTIENGESELLSCHAFT

is the assignee of the said

Rainer Lippert, Michael Frey, Helmut Mühlbacher, Klaus Peters, Hermann Pfeiffer.

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

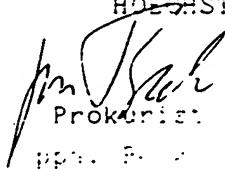
DECLARED at Frankfurt/Main, Federal Republic of Germany

this 11th day of November 1973

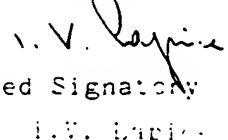
To the Commissioner of Patents

HOECHST AKTIENGESELLSCHAFT

PAT 510


John Stark
Prokurator

ppm. P. 1


I.V. Lippert
Authorized Signatory

(12) PATENT ABSTRACT (11) Document No. AU-A-82875/87
(19) AUSTRALIAN PATENT OFFICE

(54) Title

BICYCLIC IMIDES

(51)4 International Patent Classification

C07D 471/04 C07F 009/65 C07D 487/04 C07D 498/04
C07D 513/04 A61K 031/445 A61K 031/495

(21) Application No. : 82875/87 (22) Application Date : 21.12.87

(30) Priority Data

(31) Number (32) Date (33) Country
3643748 20.12.86 DE FEDERAL REPUBLIC OF GERMANY

(43) Publication Date : 23.6.88

(71) Applicant

HOECHST A.G.;

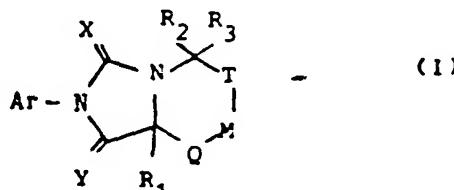
(72) Inventor

RAINER LIEBL
MICHAEL FREY
HILMAR MILDENBERGER
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HERMANN BIERINGER

(74) Attorney or Agent
EDWD. WATERS & SONS

(57) Claim

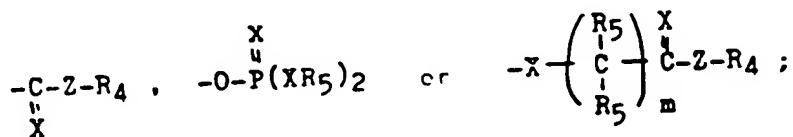
1. A compound of the formula I, or a salt thereof,



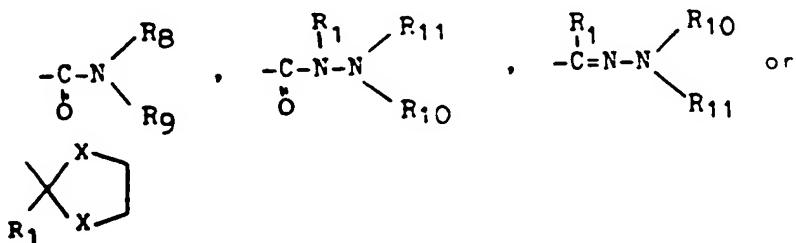
in which

Ar denotes phenyl, naphthyl, pyridyl, quinolinyl or isoquinolinyl, these radicals being monosubstituted to tetrasubstituted, preferably monosubstituted to trisubstituted, by identical or different radicals from the series comprising halogen, hydroxyl, (C₁-C₄)alkyl, halo(C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₃-C₆)-cycloalkoxy, (C₃-C₆)alkenyl, (C₃-C₆)alkynyl, (C₁-C₄)alkoxy-(C₁-C₄)-alkoxy, halo(C₁-C₄)alkoxy, halo(C₃-C₆)alkenyl, halo(C₃-C₆)alkynyl, (C₁-C₄)alkylthio, (C₁-C₄)alkylsulfinyl, (C₁-C₄)-alkylsulfonyl, NO₂, -CN, -NHR₁, cyano(C₁-C₄)alkyl, phenoxy, phenoxy(C₁-C₄)alkyl, phenyl(C₁-C₄)alkoxy, phenylthio, phenylsulfinyl or phenylsulfonyl, it being possible for the six lastmentioned radicals to

be monosubstituted, disubstituted or trisubstituted in the phenyl ring by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₁-C₄)alkoxycarbonyl, -CN or NO₂, or furthermore by a radical of the formula

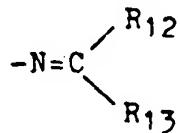


R₁ denotes hydrogen, (C₁-C₄)alkyl or phenyl which may be monosubstituted or disubstituted by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, NO₂, CN or (C₁-C₄)-alkoxycarbonyl,
 R₂ and R₃, independently of one another, denote hydrogen, (C₁-C₄)alkyl which may be substituted by cyano, hydroxyl or (C₁-C₄)alkoxy, phenyl or benzyl which may both be substituted, in each case preferably monosubstituted or disubstituted, in the phenyl ring by halogen, (C₁-C₄)alkyl, (C₁-C₄)-alkoxy, NO₂ or -CN; (C₁-C₄)alkoxy, (C₁-C₄)-alkoxycarbonyl, (C₁-C₄)-alkoxycarbonyl, (C₁-C₄)-alkoxy(C₁-C₄)-alkoxycarbonyl, (C₁-C₄)-alkoxycarbonyl(C₁-C₄)-alkoxycarbonyl, carboxyl or a radical of the formula



R₄ denotes hydrogen, (C₁-C₄)alkyl which may be monosubstituted to hexasubstituted by halogen and/or monosubstituted or disubstituted by (C₁-C₄)alkoxy, (C₁-C₄)alkoxy(C₁-C₄)alkoxy, (C₁-C₄)alkoxycarbonyl, (C₁-C₄)alkylthio, (C₁-C₄)alkylsulfinyl, (C₁-C₄)-alkylsulfonyl, (C₁-C₄)alkylamino, -CN, furyl, tetrahydrafuryl, benzofuryl, phnyl, phenoxy or

benzyloxy, it being possible for the six last-mentioned radicals to be monosubstituted to tri-substituted, in each case in the phenyl ring or the heteroaromatic ring, by halogen, (C₁-C₄)alkyl or (C₁-C₄)alkoxy, (C₃-C₆)cycloalkyl, (C₃-C₆)-alkenyl, cyclohexenyl, (C₃-C₆)alkynyl or phenyl, which may be monosubstituted to trisubstituted by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy or (C₁-C₄)alkoxycarbonyl; or a radical of the formula

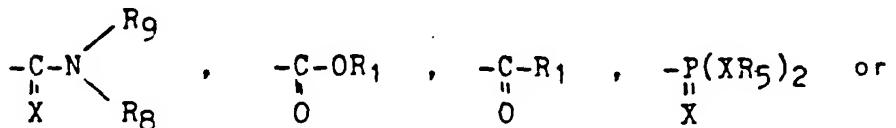


where the lastmentioned radical is excluded when
 $\text{Z} = \text{S}$,

R₅ denotes hydrogen or (C₁-C₄)alkyl,

R₆ denotes hydrogen, (C₁-C₄)alkyl or, together with F₄ and the nitrogen atom connecting these radicals, a 5- to 7-membered heterocyclic ring which can contain as ring members one or two radicals from the series comprising -O-, -S- and -NR₅- and which may be monosubstituted to trisubstituted by (C₁-C₄)alkyl;

R₇ denotes hydrogen, (C₁-C₄)alkyl, phenyl or benzyl, where the phenyl ring may in each case be monosubstituted to trisubstituted by halogen, (C₁-C₄)-alkyl, (C₁-C₄)alkoxy, (C₁-C₄)alkoxycarbonyl, -NO₂, CF₃, -CN or a radical of the formula



R₈ and R₉, independently of one another, denote hydrogen or (C₁-C₄)alkyl, or the two radicals R₈ and R₉, together with the nitrogen atom connecting them, denote a 5- to 7-membered heterocyclic ring which can contain as ring members one or two radicals from the series comprising -O-, -S- and -NR₅- and which may be monosubstituted to trisubstituted by (C₁-C₄)alkyl, hydroxyl, (C₁-C₄)alkoxy, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in the phenyl ring by (C₁-C₄)alkyl, (C₁-C₄)alkoxy, halogen or (C₁-C₄)alkoxycarbonyl,

R₁₀ and R₁₁, independently of one another, denote hydrogen, (C₁-C₄)alkyl, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in each case in the phenyl ring, by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, NO₂, -CN, CF₃ or (C₁-C₄)alkoxycarbonyl, or R₁₀ and R₁₁ together denote the



R₁₂ and R₁₃, independently of one another, denote (C₁-C₄)-alkyl, (C₁-C₄)alkoxycarbonyl, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in the phenyl ring by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₁-C₄)-alkoxycarbonyl, CF₃, -CN or NO₂,

M denotes =C₂^{R2}₃^{R3}, -S-, -S-, -S-, -O- or NR₇;

Q denotes =C₂^{R2}₃^{R3}, -S- or -O-,

T denotes  , $-S-$,  ,  or $-O-$,

x denotes 0 or s,

Y denotes O, S or NH.

Z denotes 0, S or NR_6 .

m denotes 1, 2 or 3, and

n denotes 1 or 2.

with the provis

with the proviso that m cannot be CH_2 , S , SO or SO_2 when Y denotes O , R_1 , R_2 and R_3 denote H and Q and T denotes CH_2 .

5. The use of a compound of the formula I of claim 1 or 2, or a salt thereof, as a herbicide.

COMPLETE SPECIFICATION

(ORIGINAL)

Class

Int. Class

Application Number:

Lodged:

Complete Specification Lodged:

Accepted:

Published:

Priority:

Related Art:

Name of Applicant: HOECHST AKTIENGESELLSCHAFT

Address of Applicant: 45 Bruningstrasse, D-6230 Frankfurt/Main 80,
Federal Republic of Germany

Actual Inventor: RAINER LIEBL, MICHAEL FREY, HILMAR MILDENBERGER, KLAUS BAUER and HERMANN BIERINGER

Address for Service: EDWD. WATERS & SONS,
50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

BICYCLIC IMIDES, A PROCESS FOR THEIR PREPARATION, AND
THEIR USE IN PLANT PROTECTION

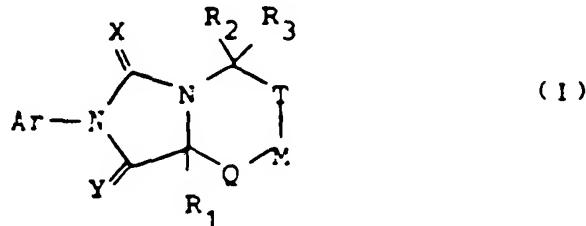
The following statement is a full description of this invention, including the best method of performing it known to the US

Bicyclic imides, a process for their preparation, and their use in plant protection

Bicyclic imides having a herbicidal activity are described in EP-A 70,389, EP-A 104,532 and US Patent 5 4,179,276.

Surprisingly, new bicyclic imides have now been found which have a markedly better herbicidal activity along with excellent selectivity.

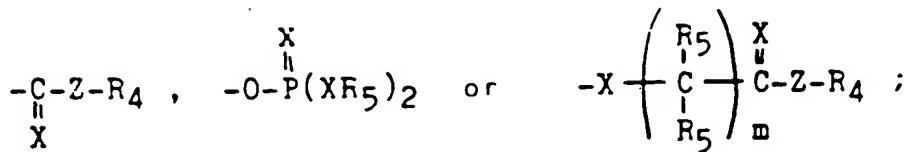
The present invention therefore relates to compounds of 10 the formula I, or their salts,



in which

Ar denotes phenyl, naphthyl, pyridyl, quinolinyl or isoquinolinyl, these radicals being monosubstituted to tetrasubstituted, preferably monosubstituted to trisubstituted, by identical or different radicals from the series comprising halogen, hydroxyl, (C₁-C₄)alkyl, halo(C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₃-C₆)-cycloalkoxy, (C₃-C₆)alkenyloxy, (C₃-C₆)-alkynyoxy, (C₁-C₄)alkoxy-(C₁-C₄)-alkoxy, halo-(C₁-C₄)alkoxy, halo(C₃-C₆)alkenyloxy, halo(C₃-C₆)-alkynyoxy, (C₁-C₄)alkylthio, (C₁-C₄)alkylsulfinyl, (C₁-C₄)alkylsulfonyl, NO₂, -CN, -NHR₁, cyano-(C₁-C₄)alkyl, phenoxy, phenoxy(C₁-C₄)alkyl, phenyl(C₁-C₄)alkoxy, phenylthio, phenylsulfinyl or phenylsulfonyl, it being possible for the six lastmentioned radicals to be monosubstituted, disubstituted or trisubstituted in the phenyl ring by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy,

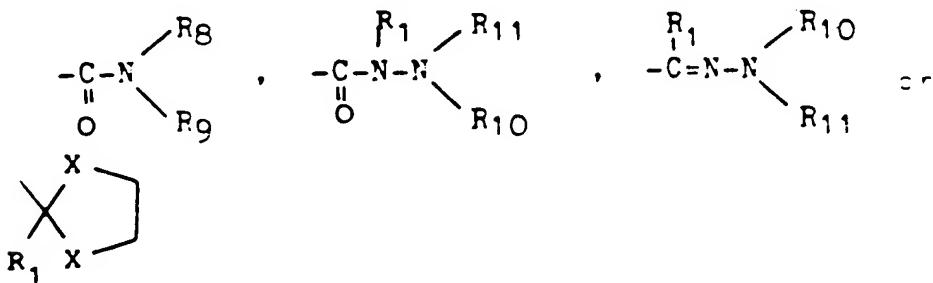
(C₁-C₄)alkoxycarbonyl, -CN or NO₂. or furthermore by a radical of the formula



R₁ denotes hydrogen, (C₁-C₄)alkyl or phenyl which may be monosubstituted or disubstituted by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, NO₂, CN or (C₁-C₄)alkoxycarbonyl,

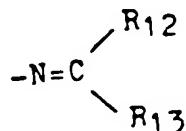
R₂ and R₃, independently of one another, denote hydrogen, (C₁-C₄)alkyl which may be substituted by cyano, hydroxyl or (C₁-C₄)alkoxy, phenyl or benzyl which may both be substituted, in each case preferably monosubstituted or disubstituted, in the phenyl ring by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, NO₂ or -CN;

(C₁-C₄)alkoxy, (C₁-C₄)-alkoxycarbonyl, halo(C₁-C₄)alkoxycarbonyl, (C₁-C₄)-alkoxy(C₁-C₄)alkoxycarbonyl, (C₁-C₄)-alkoxycarbonyl(C₁-C₄)alkoxycarbonyl, carbonyl or a radical of the formula



R₄ denotes hydrogen, (C₁-C₄)alkyl which may be monosubstituted to hexasubstituted by halogen and/or monosubstituted or disubstituted by (C₁-C₄)alkoxy, (C₁-C₄)alkoxy(C₁-C₄)alkoxy, (C₁-C₄)alkoxy-carbonyl, (C₁-C₄)alkylthio, (C₁-C₄)alkylsulfinyl, (C₁-C₄)alkylsulfonyl, (C₁-C₄)alkylamino, -CN, furyl, tetrahydrofuryl, benzofuryl, phenyl, phenoxy

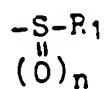
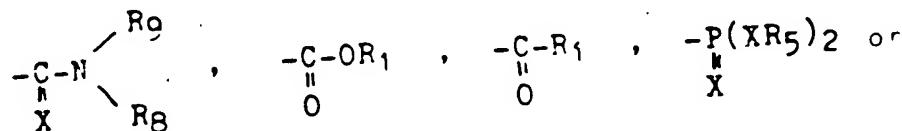
5 or benzyloxy, it being possible for the six last-mentioned radicals to be monosubstituted to tri-substituted, in each case in the phenyl ring or the heteroaromatic ring, by halogen, (C₁-C₄)alkyl or (C₁-C₄)alkoxy, (C₃-C₆)cycloalkyl, (C₃-C₆)alkenyl, (C₃-C₆)alkynyl or phenyl, which may be monosubstituted to trisubstituted by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy or (C₁-C₄)alkoxycarbonyl; or a radical of the formula



where the lastmentioned radical is excluded when
20 Z = S,
R₅ denotes hydrogen or (C₁-C₄)alkyl,

15 R₆ denotes hydrogen, (C₁-C₄)alkyl or, together with R₄ and the nitrogen atom connecting these radicals, a 5- to 7-membered heterocyclic ring which can contain as ring members one or two radicals from the series comprising -O-, -S- and -NR₅- and which may be monosubstituted to trisubstituted by (C₁-C₄)alkyl;

20 R₇ denotes hydrogen, (C₁-C₄)alkyl, phenyl or benzyl, where the phenyl ring may in each case be monosubstituted to trisubstituted by halogen, (C₁-C₄)-alkyl, (C₁-C₄)alkoxy, (C₁-C₄)alkoxycarbonyl, -NO₂, CF₃, -CN or a radical of the formula

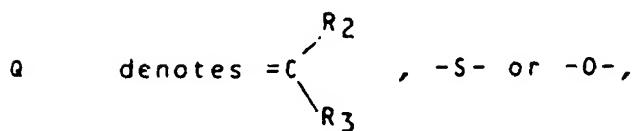
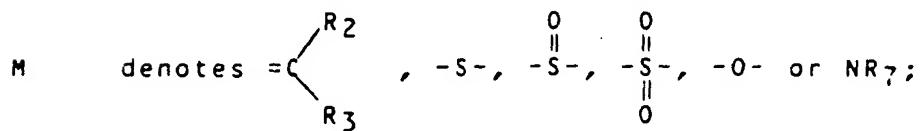


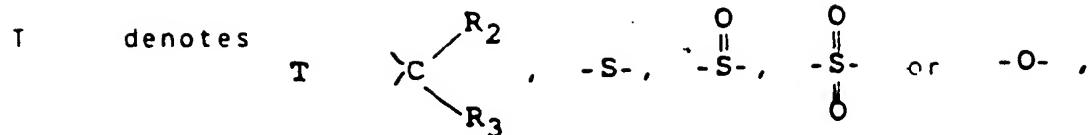
or (C_1-C_4) alkyl, or the two radicals R_8 and R_9 , together with the nitrogen atom connecting them, denote a 5- to 7-membered heterocyclic ring which can contain as ring members one or two radicals from the series comprising $-O-$, $-S-$ and $-NR_5-$ and which may be monosubstituted to trisubstituted by (C_1-C_4) alkyl, hydroxyl, (C_1-C_4) alkoxy, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in the phenyl ring by (C_1-C_4) alkyl, (C_1-C_4) alkoxy, halogen or (C_1-C_4) alkoxycarbonyl,

R_{10} and R_{11} , independently of one another, denote hydrogen, (C_1-C_4) alkyl, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in each case in the phenyl ring, by halogen, (C_1-C_4) alkyl, (C_1-C_4) alkoxy, NO_2 , $-CN$, CF_3 or (C_1-C_4) alkoxycarbonyl, or R_{10} and R_{11} together denote the



R_{12} and R_{13} , independently of one another, denote (C_1-C_4) alkyl, (C_1-C_4) alkoxycarbonyl, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in the phenyl ring by halogen, (C_1-C_4) alkyl, (C_1-C_4) alkoxy, (C_1-C_4) alkoxycarbonyl, CF_3 , $-CN$ or NO_2 ,





X denotes O or S,
 Y denotes O, S or NH,
 Z denotes O, S or NR_6 ,
 5 m denotes 1, 2 or 3, and
 n denotes 1 or 2,
 with the proviso that M cannot be CH_2 , S, SO or SO_2
 when Y denotes O, R_1 , R_2 and R_3 denote H and Q and
 T denotes CH_2 .

10 The compounds of the formula I can exist as pure stereo-isomers or as mixtures thereof. All these isomeric forms are covered by the invention.

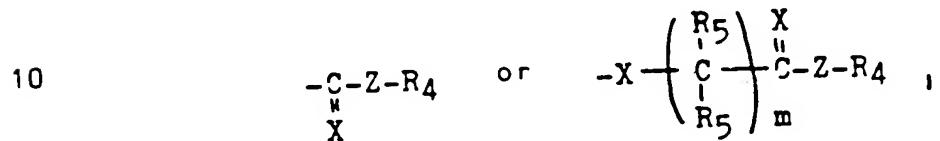
Salt formation in the case of the compounds of the formula I can take place when R_2 or R_3 denotes carboxyl or
 15 when ZR_4 denotes OH or SH. Possible salts are generally those which can be employed in agriculture. These include, for example, the alkali metal salts and alkaline-earth metal salts, in particular Na, K, Mg and Ca salts, or the salts with ammonium, which may be monosubstituted
 20 to tetrasubstituted by organic radicals, in particular alkyl or hydroxyalkyl radicals.

In the definition of formula I, haloalkyl, haloalkoxy, haloalkenyloxy or haloalkynyloxy contains one or more halogen atoms, mainly one to six F, Cl or Br atoms.
 25 These include, for example, the $-\text{CF}_3$, $-\text{C}_2\text{F}_5$, $-\text{CH}_2\text{CF}_3$, $-\text{CF}_2\text{Cl}$, $-\text{CF}_2\text{CHF}_2$, $-\text{CF}_2\text{CHFCl}$, $-\text{CF}_2-\text{CH}_2-\text{CF}_3$, $-\text{CF}_2-\text{CHFBr}$, $-\text{OCF}_3$, $-\text{OCF}_2-\text{CHF}_2$, $-\text{OCF}_2-\text{CHFCl}$, $-\text{OCF}_2-\text{CHCl}_2$, $-\text{OCF}_2-\text{CHFBr}$, and $-\text{OCF}_2-\text{CHF}-\text{CF}_3$ radicals.

Suitable heterocyclic radicals for the $\text{R}_6-\text{N}-\text{R}_4$ or $\text{R}_8-\text{N}-\text{R}_9$
 30 group are, in particular, piperidine, pyrrolidine, morpholine and 2,6-dimethylmorpholine.

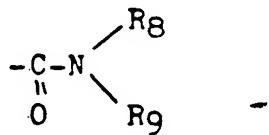
Preferred compounds of the formula I are those compounds in which

Ar denotes phenyl, which may be monosubstituted to trisubstituted by fluorine, chlorine, bromine, 5 (C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₃-C₄)alkenyloxy, (C₃-C₄)alkynyloxy, halo(C₁-C₄)alkyl, halo(C₁-C₄)-alkoxy, -NHR₁, (C₁-C₄)alkylthio, (C₁-C₄)alkylsulfonyl, NO₂ or a radical of the formula



R₁ denotes hydrogen, (C₁-C₄)alkyl or (C₁-C₄)alkoxy-carbonyl,

R₂ and R₃, independently of one another, denote hydrogen, 15 (C₁-C₄)alkyl, (C₁-C₄)alkoxycarbonyl, (C₁-C₄)-alkoxy(C₁-C₄)alkoxycarbonyl, halo(C₁-C₄)alkoxy-carbonyl, (C₁-C₄)alkoxycarbonyl(C₁-C₄)alkoxy-carbonyl, -CN, carboxyl or



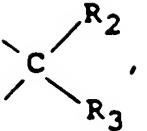
R₄ denotes (C₁-C₄)alkyl, halo(C₁-C₄)alkyl, (C₁-C₄)-alkoxyalkyl or (C₁-C₄)alkoxycarbonyl(C₁-C₄)alkyl; 20

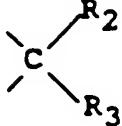
R₅ denotes H or (C₁-C₄)alkyl,

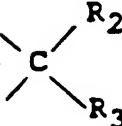
R₇ denotes hydrogen, (C₁-C₄)alkyl,
$$-C\begin{smallmatrix} R_8 \\ \parallel \\ X \end{smallmatrix} N \begin{array}{c} R_8 \\ | \\ R_9 \end{array} ;$$

phenyl or benzyl, which may both be monosubstituted or disubstituted by (C₁-C₄)alkyl, (C₁-C₄)alkoxy, 25 halogen, NO₂ or -CF₃,

R₈ and R₉ denote hydrogen, (C₁-C₄)alkyl or, together with the nitrogen atom connecting them, a 6-membered saturated heterocyclic ring,

M denotes  -O- or -NR₇-

Q denotes 

T denotes  or -S- ,

X denotes O or S,
5 Y denotes O or NH,
Z denotes O or S and
m denotes 1.

Particularly preferred compounds of the formula I are those compounds in which

10 Ar denotes phenyl, which may be monosubstituted to trisubstituted by fluorine, chlorine, bromine, (C₁-C₄)-alkyl, (C₁-C₄)alkoxy, halo(C₁-C₄)alkoxy, (C₃-C₄)-alkenyloxy, (C₃-C₄)alkynyloxy or (C₁-C₄)alkylthio,

15 R₁ denotes hydrogen or (C₁-C₄)alkyl,

R₂ and R₃, independently of one another, denote hydrogen or (C₁-C₄)alkyl,

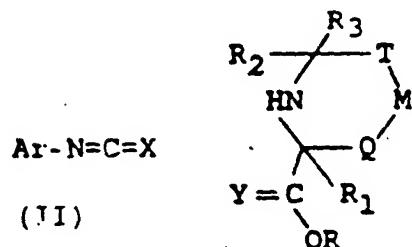
M denotes >CR₂R₃ or oxygen,

Q and T denote >CR₂R₃, and

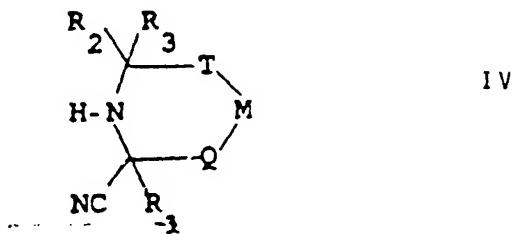
20 X and Y denote oxygen.

The invention furthermore relates to a process for the preparation of compounds of the formula (I), or salts

a) where Y = O or S, a compound of the formula II is reacted with a compound of the formula III



5 in which R denotes H or (C₁-C₄)alkyl, or
b) a compound of the formula II is reacted with an amine
of the formula IV



or

10 c) where $Y = 0$, a compound of the formula I obtained
under b) is hydrolyzed, and the compound obtained is
converted, if appropriate, into its salt.

In process variant a), the reaction for R = alkyl takes place in an inert organic solvent, for example an aro-

15 matic solvent such as toluene or chlorobenzene, a halo-
genated hydrocarbon such as chloroform, an ether such as
diisopropyl ether or in dimethylformamide, if appropriate
with base catalysis, at temperatures from 20 to 120°C,
preferably 60 to 100°C. The bases employed are prefer-
26 ably organic bases, for example organic amines such as
triethylamine or alternatively pyridine.

The reaction for R = hydrogen can alternatively be carried out in water as the solvent or, preferably, in the water/organic solvent 2-phase system. The procedure

is particularly preferred here in which the compound of the formula III is converted into the anion using an inorganic base, for example an alkali metal hydroxide, carbonate or hydrogen carbonate or alkaline-earth metal 5 hydroxide, carbonate or hydrogen carbonate, such as sodium hydroxide or alternatively potassium carbonate, or an organic base, for example an organic amine such as triethylamine. In order to dissolve the anion in water, the isocyanate or isothiocyanate of the formula II, dissolved in an inert organic solvent such as, for example, toluene, chlorobenzene or chloroform is then added drop-wise with vigorous stirring.

The pH of the aqueous phase is then adjusted to a value between 1 and 3 using an acid, preferably using a mineral 15 acid such as hydrochloric acid or sulfuric acid, and subsequently reacted further at temperatures between 50 and 100°C.

In process variant b), the reaction takes place in an inert organic solvent, for example an aromatic solvent 20 such as toluene or chlorobenzene, a halogenated hydrocarbon such as chloroform or in dimethylformamide, at temperatures from 20 to 120°C, preferably 60 to 100°C.

The hydrolysis in process variant c) takes place in water or aqueous mineral acid, if appropriate in the presence of an inert organic solvent, at temperatures between 25 20 and 120°C, preferably 60 and 100°C. Possible organic solvents are, for example, water-immiscible solvents such as aromatic solvents (for example toluene or chlorobenzene) or halogenated hydrocarbons (for example 30 chloroform).

The compounds of the formula (II) are known or can be prepared analogously to known processes, cf. Houben-Weyl, Methoden der organischen Chemie [Methods of Organic Chemistry], Vol. VIII, p. 120 (1952), Houben-Weyl Vol. IX, 35 p. 875, 869 (1955).

SOME AMINES OF THE FORMULA ... ARE OBTAINED
T = CR₂R₃ AND Q AND T = CR₂R₃ AND M = NR₇, THEY CAN BE
OBTAINED BY SIMPLE CATALYTIC HYDROGENATION OF THE CORRE-
SPONDING PYRIDINE OR PYRAZINE DERIVATIVES. AMINES OF THE
5 FORMULA III CAN ALSO BE PREPARED FROM AMINES OF THE FOR-
MULA IV BY CONVERSION OF THE NITRILE GROUP BY CONVEN-
TIONAL METHODS, CF., FOR EXAMPLE, ORG. SYNTH. COLL.
VOL. I, P. 321 (1941) OR HOUBEN-WEYL VOL. VIII, P. 536.

SOME AMINES OF THE GENERAL FORMULA IV ARE KNOWN FROM JP-A
10 3073-569 OR THEY CAN BE PREPARED ANALOGOUSLY TO THE PRO-
CESS DESCRIBED THEREIN.

THE COMPOUNDS OF THE FORMULA I ACCORDING TO THE INVENTION
HAVE AN EXCELLENT HERBICIDAL ACTIVITY AGAINST A BROAD
RANGE OF ECONOMICALLY IMPORTANT MONOCOTYLEDON AND DICOTY-
15 LEDON HARMFUL PLANTS. EVEN PERENNIAL WEEDS WHICH ARE
DIFFICULT TO CONTROL AND PUT OUT RHIZOMES, ROOTSTOCKS OR
OTHER PERMANENT ORGANS ARE WELL COVERED BY THE ACTIVE
COMPOUNDS. AT THE SAME TIME, IT IS IMMATERIAL WHETHER
THE SUBSTANCES ARE APPLIED USING PRESOWING, PREEMERGENCE
20 OR POSTEMERGENCE METHODS.

THE FOLLOWING ARE EXAMPLES OF HARMFUL PLANTS WHICH CAN BE
CONTROLLED: WEED GRASSES, SUCH AS AVENA FATUA, ALOPECURUS
SP., LOLIUM SP., SETARIA SP., DIGITARA SP., SORGHUM HALE-
PENSE, ECHINOCHLOA SP., AGROPYRON SP., CYDONON SP. AND
25 PHALARIS SP., AND DICOTYLEDON PLANTS, SUCH AS LAMIUM SP.,
VERONICA SP., GALIUM S., STELLARIA SP., MATRICARIA SP.,
PAPAVER SP., CENTAURIA SP., AMARANTHUS SP., GALINSOGA SP.,
MERCURIALIS SP., SIDA SP., ABUTILON SP., AMBROSIA SP.,
XANTHIMUM SP., CIRSIUM SP., ARTEMISIA SP., RUMEX SP.,
30 CONVOLVULUS SP., IPOMEA SP. AND SINAPIS SP..

IF THE COMPOUNDS ACCORDING TO THE INVENTION ARE APPLIED
TO THE SOIL SURFACE BEFORE GERMINATION, EITHER EMERGENCE
OF THE WEED SEEDLINGS IS ENTIRELY PREVENTED, OR THE WEEDS
GROW TO THE SEED LEAF STAGE, BUT THEN STOP GROWING AND
FINALLY DIE COMPLETELY AFTER THREE TO FIVE WEEKS HAVE

... application of the active compounds to the green parts of the plants using the postemergence method, a drastic cessation of growth likewise occurs very rapidly after the treatment, and the weed plants remain 5 at the stage of growth present at the time of application or die completely more or less quickly after a certain time, so that weed competition which is harmful for the crop plants can in this way be eliminated very early and lastingly through use of the novel agents according to 10 the invention.

... Although the compounds according to the invention have an excellent herbicidal activity against monocotyledon and dicotyledon weeds, crop plants of economically important crops, such as, for example, wheat, barley, rye, rice, 15 corn, sugarbeet, cotton and soybean, are damaged only insignificantly or not at all. For these reasons, the present compounds are very highly suitable for selective control of undesired plant growth in agricultural crop plants.

20 In addition, the compounds according to the invention have growth-regulating properties in crop plants. They have a regulating action on the plant's inherent metabolism, and can thus be employed for simplifying harvesting, such as, for example, by initiating desiccation, 25 abscission and stunting of growth. In addition, they are also suitable for general control and inhibition of undesired vegetative growth without at the same time killing the plants. Inhibition of vegetative growth plays an important part in many monocotyledon and dicotyledon 30 crops since lodging can thereby be reduced or completely prevented.

The compounds according to the invention can be used in the conventional preparations, if appropriate mixed with further active compounds, as wettable powders, emulsifiable 35 concentrates, sprayable solutions, dressings, dusts, dispersions, granules or microgranules.

Wettable powders are preparations, uniformly dispersible in water, which, besides the active compounds and in addition to a diluent or inert material, contain wetting agents, for example polyoxethylated alkylphenols, poly-
5 oxethylated fatty alcohols, alkyl- or alkylphenylsulfonates and/or dispersing agents, such as sodium lignin-
sulfonate, sodium 2,2'-dinaphthylmethane-6,6'-disulfonate, sodium dibutylnaphthalenesulfonate, or alternatively sodium oleoylmethyltaurinate. They are produced in a
10 conventional fashion, for example by grinding and mixing the components.

Emulsifiable concentrates can be produced, for example, by dissolving the active compounds in an inert organic solvent, such as butanol, cyclohexanone, dimethylform-
15 amide, xylene or alternatively higher-boiling aromatics or aliphatic or cycloaliphatic hydrocarbons, with addition of one or more emulsifiers. In the case of liquid active compounds, the solvent component can also be omitted entirely or partly. As emulsifiers, the following can be used, for example: calcium salts of alkyl-arylsulfonic acid, such as Ca dodecylbenzenesulfonate, or nonionic emulsifiers, such as fatty acid polyglycol esters, alkylaryl polyglycol ethers, fatty alcohol polyglycol ethers, propylene oxide/ethylene oxide condensation products, fatty alcohol/propylene oxide condensation products, alkyl polyglycol ethers, sorbitan fatty acid esters, polyoxethylene sorbitan acid esters or polyoxethylene sorbitol esters.

Dusts can be obtained by grinding the active compounds with finely divided solids, for example talc, natural clays, such as kaolin, bentonite, pyrophyllite or diatomaceous earth.

Granules can be produced either by atomizing the active compounds onto adsorptive, granulated inert material or
35 by applying active compound concentrates onto the surface of carrier materials, such as sand or kaolinite, or of

granulated inert material by means of binders, for example polyvinyl alcohol, sodium polyacrylate or alternatively mineral oils. Suitable active compounds can also be granulated in the manner which is conventional 5 for the production of fertilizer granules - if desired as a mixture with fertilizers.

The active compound concentration in wettable powders is about 10 to 90% by weight, the remainder to 100% by weight comprising conventional formulation components.

10 In the case of emulsifiable concentrates, the active compound concentration can be about 5 to 80% by weight. Dust formulations usually contain 0.05 to 20% by weight of active compound(s), and sprayable solutions about 2 to 20% by weight. In the case of granules, the active 15 compound content depends partly on whether the active compound is present in liquid or solid form and on which granulation auxiliaries, fillers etc. are used.

In addition, the active compound formulations mentioned contain, if appropriate, the adhesives, wetting agents, 20 dispersants, emulsifiers, penetrants, solvents, fillers or excipients which are conventional in each case.

For use, the concentrates, present in commercially available form, are diluted, if appropriate, in a conventional fashion, for example using water in the case of wettable 25 powders, emulsifiable concentrates, dispersions and, in some cases, also in the case of microgranules. Dusts and granulated formulations, and also sprayable solutions, are usually not further diluted with further inert substances before use.

30 The application rate necessary varies with the external conditions, such as temperature, humidity, inter alia. It can vary within broad limits, for example between 0.005 and 10.0 kg/ha or more of active substance, but is preferably between 0.01 and 2 kg/ha.

Mixtures of the mixed formulations with other active compounds, such as, for example, insecticides, acaricides, herbicides, fertilizers, growth regulators or fungicides, may also be possible.

5 The invention is illustrated by the following examples.

A. Formulation examples

A dust is obtained by mixing 10 parts by weight of active compound and 90 parts by weight of talc or inert material, and comminuting the mixture in a hammer mill.

10 A wettable powder which is easily dispersible in water is obtained by mixing 25 parts by weight of active compound, 64 parts by weight of kaolin-containing quartz as inert material, 10 parts by weight of potassium lignin-sulfonate and 1 part by weight of sodium oleoylmethyltaurinate as wetting and dispersing agent, and grinding the mixture in a pin disk mill.

A dispersing concentrate which is easily dispersible in water is obtained by mixing 20 parts by weight of active compound with 6 parts by weight of alkylphenol polyglycol ether (Triton X 207), 3 parts by weight of isotridecanol polyglycol ether (8 EO) and 71 parts by weight of paraffinic mineral oil (boiling range, for example, about 255 to above 377°C), and grinding the mixture in a ball mill to a fineness below 5 microns.

25 An emulsifiable concentrate is obtained from 15 parts by weight of active compound, 75 parts by weight of cyclohexanone as solvent and 10 parts by weight of oxethylated nonylphenol (10 EO) as emulsifier.

Example 1

1-Ethoxycarbonylethyl 8-(4-chloro-3-ethoxycarbonylphenyl)-7,9-dioxo-1,8-diazabicyclo[4.3.0]nonane-2-carboxylate

5 37.3 g (0.10 mol) of bis-(1-ethoxycarbonylethyl) piperidine-2,6-biscarboxylate were dissolved in 200 ml of toluene. 22.6 g (0.10 mol) of 4-chloro-3-ethoxycarbonylphenyl isocyanate, dissolved in 50 ml of toluene, were added dropwise at 20 - 30°C. After stirring for 1 hour
10 at room temperature, the mixture was stirred for a further 3 hours at 80°C. After removing the solvent by distillation, the solid which remained was recrystallized from methanol. 39.5 g (82% of theory) of 1-ethoxycarbonylethyl 8-(4-chloro-3-ethoxycarbonylphenyl)-7,9-dioxo-15 1,8-diazabicyclo[4.3.0]nonane-2-carboxylate were obtained in the form of colorless crystals of melting point: 121 - 128°C.

Example 2

8-(4-Chloro-2-fluoro-5-methoxyphenyl)-2-methyl-7,9-dioxo-20 1,8-diazabicyclo[4.3.0]nonane

20.2 g (0.10 mol) of 4-chloro-2-fluoro-5-methoxyphenyl isocyanate, dissolved in 100 ml of toluene, were added dropwise to 17.1 g (0.10 mol) of ethyl 6-methylpiperidine-2-carboxylate in 100 ml of toluene. The mixture was
25 stirred for 3 hours at 100°C. The solvent was removed by distillation under reduced pressure, and the residue was dried in a high vacuum to constant weight. 33.0 g (99% of theory) of 8-(4-chloro-2-fluoro-5-methoxyphenyl)-2-methyl-7,9-dioxo-1,8-diazabicyclo[4.3.0]nonane were
30 obtained in the form of a pale yellow syrup.

Example 3

Ethyl 8-(4-chloro-2-fluoro-5-methoxyphenyl)-7,9-dioxo-1,8-diazabicyclo[4.3.0]nonane-3-carboxylate

20.2 g (0.1 mol) of 4-chloro-2-fluoro-5-methoxyphenyl
5 isocyanate, dissolved in 100 ml of chlorobenzene, were
added dropwise to 22.9 g (0.1 mol) of diethyl piperidine-
2,5-dicarboxylate in 150 ml of chlorobenzene. The mix-
ture was stirred for 3 hours at 100°C, the solvent was
removed by distillation, and the residue was dried in a
10 high vacuum to constant weight. 37.8 g (98% of theory)
of ethyl 8-(4-chloro-2-fluoro-5-methoxyphenyl)-7,9-dioxo-
1,8-diazabicyclo[4.3.0]nonane-3-carboxylate were obtained
in the form of a honey-colored syrup.

Example 4

Ethyl 8-(4-chloro-2-fluoro-5-methoxyphenyl)-7,9-dioxo-1,4,8-triazabicyclo[4.3.0]nonane-5-carboxylate

10.1 g (0.05 mol) of 4-chloro-2-fluoro-5-methoxyphenyl
isocyanate, dissolved in 70 ml of toluene, were added
dropwise within 1 hour to 11.5 g (0.05 mol) of diethyl
20 piperazine-2,3-dicarboxylate in 100 ml of toluene at
20°C. The mixture was subsequently stirred for 4 hours
at 100°C, and the solvent was removed by distillation.
The residue which remained was triturated with hexane and
the solid was filtered off under suction. 14.8 g (77% of
25 theory) of ethyl 8-(4-chloro-2-fluoro-5-methoxyphenyl)-
7,9-dioxo-1,4,8-triazabicyclo[4.3.0]nonane-5-carboxylate
were obtained in the form of pale yellow crystals of
melting point 56 - 58°C.

Example 5

8-(4-Chlorophenyl)-7-imino-9-oxo-1,8-diazabicyclo[4.3.0]-nonane

15.4 g (0.1 mol) of 4-chlorophenyl isocyanate, dissolved
in 50 ml of toluene, were added dropwise to 11.0 g (0.1
mol) of 2-cyanopiperidine in 80 ml of toluene. The

mixture was stirred for 4 hours at 100°C, and the solvent was removed by distillation. 26.0 g (98% of theory) of 8-(4-chlorophenyl)-7-imino-9-oxo-1,8-diazabicyclo[4.3.0]-nonane were obtained in the form of a pale brown glassy material.

Example 6

8-(4-Chloro-2-fluoro-5-methoxyphenyl)-3,5-dimethyl-7,9-dioxo-4-oxa-1,8-diazabicyclo[4.3.0]nonane

20.2 g (0.10 mol) of 4-chloro-2-fluoro-5-methoxyphenyl isocyanate, dissolved in 100 ml of toluene, were added dropwise to 13.9 g (0.10 mol) of 3-cyano-2,6-dimethylmorpholine in 100 ml of toluene. The mixture was stirred for 3 hours at 100°C. After 50 ml of 20% strength aqueous hydrochloric acid had been added, the mixture was stirred for a further 2 hours at 100°C. The organic phase was separated off, washed twice with 100 ml of water and dried over sodium sulfate. The tacky, solid residue remaining after the solvent had been stripped off was triturated with diisopropyl ether. 26.4 g (77% of theory) of 8-(4-chloro-2-fluoro-5-methoxyphenyl)-3,5-dimethyl-7,9-dioxo-4-oxa-1,8-diazabicyclo[4.3.0]nonane were obtained in the form of colorless crystals of melting point 126 - 131°C.

Example 7

8-(4-Chloro-2-fluoro-5-methoxyphenyl)-7,9-dioxo-3-thia-1,8-diazabicyclo[4.3.0]nonane

20.2 g (0.10 mol) of 4-chloro-2-fluoro-5-methoxyphenyl isocyanate, dissolved in 50 ml of toluene, were added dropwise to 17.5 g (0.10 mol) of ethyl 1,3-thiazane-4-carboxylate in 150 ml of toluene. The mixture was stirred for 4 hours at 100°C, and the solvent was removed by distillation. The solid which remained was triturated with di-isopropyl ether and dried. 24.9 g (75% of theory) of 8-(4-chloro-2-fluoro-5-methoxyphenyl)-7,9-dioxo-3-thia-1,8-diazabicyclo[4.3.0]nonane were

obtained in the form of pale yellow crystals of melting point 55 - 61°C.

Example 8

8-(4-Chloro-2-fluoro-5-propargyloxyphenyl)-2-(1,3-dioxolan-2-yl)-7,9-dioxo-5
1,8-diazabicyclo[4.3.0]nonane

11.3 g (0.05 mol) of 4-chloro-2-fluoro-5-propargyloxyphenyl isocyanate, dissolved in 50 ml of toluene, were added dropwise to 11.5 g (0.05 mol) of ethyl 6-(1,3-dioxolan-2-yl)-piperidine-2-carboxylate in 100 ml of toluene. After the mixture had been stirred for 3 hours at 100°C, the solvent was removed by distillation, and the residue was dried in a high vacuum to constant weight. 19.8 g (97% of theory) of 8-(4-chloro-2-fluoro-5-propargyloxyphenyl)-2-(1,3-dioxolan-2-yl)-7,9-dioxo-5,1,8-diazabicyclo[4.3.0]nonane were obtained in the form of a colorless glass.

Example 9

4-Benzyl-8-(4-chloro-2-fluoro-5-isopropoxyphenyl)-7,9-dioxo-1,4,8-triazabicyclo[4.3.0]nonane

11.5 g (0.05 mol) of 4-chloro-2-fluoro-5-isopropoxyphenyl isocyanate, dissolved in 50 ml of toluene, were added dropwise to 12.4 g (0.05 mol) of ethyl 4-benzylpiperazine-2-carboxylate in 100 ml of toluene. The mixture was stirred for 3 hours at 100°C, and the solvent was removed by distillation. After drying the residue in HV¹⁾ to constant weight, 30.7 g (96% of theory) of 4-benzyl-8-(4-chloro-2-fluoro-5-isopropoxyphenyl)-7,9-dioxo-1,4,8-triazabicyclo[4.3.0]nonane were obtained in the form of a pale yellow syrup.

30 HV = high vacuum

Example 10

2,2,2-Trifluoroethyl 8-(4-chloro-2-fluoro-5-methoxy-phenyl)-7-oxo-9-thioxo-1,8-diazabicyclo[4.3.0]nonane-2-carboxylate

5 10.9 g (0.05 mol) of 4-chloro-2-fluoro-5-methoxyphenyl isothiocyanate, dissolved in 70 ml of toluene, were added dropwise to 16.9 g (0.05 mol) of bis(2,2,2-trifluoroethyl) piperidine-2,6-dicarboxylate in 150 ml of toluene, and the mixture was stirred for 6 hours at 100°C. After the 10 solvent had been removed by distillation, the residue was triturated with n-hexane and dried. 19.8 g (87% of theory) of 2,2,2-trifluoroethyl 8-(4-chloro-2-fluoro-5-methoxyphenyl)-7-oxo-9-thioxo-1,8-diazabicyclo[4.3.0]-nonane-2-carboxylate were obtained in the form of pale 15 beige crystals of melting point 134 - 138°C.

The compounds (I) of Table 1 below can be prepared in an analogous fashion.

Table 1

Example No.	X	Y	Z	W	T	R ₁	R ₂	R ₃	M.μ(“C”)
11	4-C1-C ₆ H ₄	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H		-H
12	4-C1-2-1-5-OCH ₃ -C ₆ H ₂	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CO ₂ C ₂ H ₅	-H
13	4-C1-2-F-5-OCH ₃ -C ₆ H ₂	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CO ₂ CH ₂ CF ₃ -H	104.109
14	4-C1-2-F-5-OCH ₃ -C ₆ H ₂	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-C-N<C>-	-H
15	"	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	-H
16	"	0	0	2CH ₂ -CO ₂ C ₂ H ₅	-CH ₂ -	-CH ₂ -	-H	-H	-H
17	"	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CO ₂ CH(C ₆ H ₅) ₂ -H	61.071
18	"	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CO ₂ CH ₂ OH-COOH ₃ -H	61.071
19	"	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OH-CO ₂ CH ₃ -H	61.071
20	"	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OH	-H
21	4-C1-2-F-5-OCH(CH ₃) ₂ -	0	0	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OH	-H
				-CH ₂ H ₂					

Exemplar	Ar	χ	γ	θ	\mathbf{M}	τ	R_1	R_2	R_3	$\eta \cdot \theta ({}^\circ C)$
22	4-C1-2-f-5-OC ₂ H ₅ -f ₆ H ₇	0	0	-CH ₂ -	-CH ₂ -CO ₂ C ₂ H ₅]-H, H	-H	Syrup			
23	"	0	0	-CH ₂ -	-H-CO ₂ C ₂ H ₅	-CH ₂ -	-H-CO ₂ C ₂ H ₅	-H	Glass	
24	2,4-Br-2-f ₂ -5-CO ₂ C ₂ H ₅ -C ₆ H ₂	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	Syrup		
25	4-Br-3-CO ₂ -CH(CH ₃) ₂ -C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	Syrup		
26	4-C1-2-(m,p-dinitrophenyl)-C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -CH ₃	-H	Glass			
27	4-C1-3-(m,p-dinitrophenyl)-	0	0	-CH ₂ -CO ₂ CH ₃	-CH ₂ -	-H-CH ₃	-H	Glass		
28	4-C1-2-f ₂ -5-CO ₂ H ₅ -C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -	-H-CO ₂ CH ₃	-H	Syrup		
29	3-CO ₂ C ₂ H ₅ -4-OC ₂ H ₅ -C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -	-H-CO ₂ CH ₃	-H	Syrup		
30	3-CO ₂ C ₂ H ₅ -4-OC ₂ H ₅ -C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -	-H-CO ₂ CH ₂ CF ₃	-H	Glass		
31	2-f-4-OC ₂ H ₅ -5-OC ₂ H ₅ -C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	0.11		
32	4-C1-2-f ₂ -5-OC ₂ H ₅ -C ₆ H ₃	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	Resin		
33	"	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	Resin		
34	"	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	Glass		
35	"	0	0	-CH ₂ -	-CH ₂ -	-H-CH ₃	-H	Glass		

Examp le	Ar	λ	γ	θ	\mathbf{M}	\mathbf{T}	\mathbf{R}_1	\mathbf{R}_2	\mathbf{R}_3	$\mathbf{M} \cdot \mathbf{P}(0^\circ)$
36	4-Cl-2-F-5-OCH ₃ -C ₆ H ₅	S	C	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OHCH ₂ -	-H	-H	Glass
37	"	S	0	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OC ₂ H ₅ CH ₃ -	-H	-H	Syrup
38	4-Br-3-(CH ₂ O)(CH ₂) ₂ -C ₆ H ₃	S	0	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OC ₂ H ₅ CH ₃ -	-H	-H	Resin
39	4-Cl-3-(CH ₂ O)(CH ₂) ₂ CH ₂ -C ₆ H ₃	S	0	-CH ₂ -	-CH ₂ -	-H	-CH ₂ OC ₂ H ₅ CH ₃ -	-H	-H	Syrap
40	4-Cl-2-F-5-OCH ₃ -C ₆ H ₅	0	0	-CH ₂ CO ₂ C ₂ H ₅	-NH-	-CH ₂ -	-H	-H	-H	Resin
41	4-Cl-2-F-5-OCH ₃ OCH ₃ -C ₆ H ₅	0	0	-CH ₂ -	-NH-CH ₃	-CH ₂ -	-H	-H	-H	Resin
42	4-Cl-2-F-5-OCH ₂ -C ₆ H ₂	0	0	-CH ₂ -	-N=C=NHCO ₂ H ₃	-CH ₂ -	-H	-H	-H	Glass
43	4-Cl-2-F-5-OCH ₃ -C ₆ H ₂	0	0	-CH ₂ CO ₂ C ₂ H ₅	-N=C=NHCO ₂ H ₃	-CH ₂ -	-H	-H	-H	Glass
44	"	0	0	-CH ₂ -	-N=C=NHCO ₂ C ₂ H ₅	-CH ₂ -	-H	-H	-H	Syrap
45	"	0	0	-CH ₂ -	-N=C=CH ₃	-CH ₂ -	-H	-H	-H	Resin
46	"	0	0	-CH ₂ CO ₂ C ₂ H ₅	-N=C=CH ₃	-CH ₂ -	-H	-H	-H	Resin
47	"	0	0	-CH ₂ CO ₂ C ₂ H ₅	-N=C=NHCO ₂ H ₃	-CH ₂ -	-H	-H	-H	Resin

Experiments	Ar	X	Y	0	H	I	R ₁	R ₂	R ₃	" . P(⁰ C _i)
75	4-00H ₂ CF ₃ -3-MeC ₂ H ₅ -C ₆ H ₃	0	NH	C ₆ H ₃	-0-	-CH ₂ -	-H	-H	-H	Resin, in
76	4-Cl-2-F-5-00CH ₃ -C ₆ H ₂	0	NH	-CH ₂ -	-CH ₂ -CH ₃	-CH ₂ -	-H	-H	-H	Glass
77	"	0	NH	-CH ₂ -CH ₃	-CH ₂ -	-CH ₂ -CH ₃	-H	-H	-H	Glass
78	"	0	NH	-CH ₂ -	-CH ₂ -	-CH ₂ -	OH ₃	-CH ₃	-H	Syrup
79	"	0	NH	-CH ₂ -	-CH ₂ -	-CH ₂ -	OH ₃	-CH ₃	-H	Syrup
80	"	0	NH	-CH ₂ -	-CH ₂ -CH ₃	-CH ₂ -	-OH ₃	-CH ₃	-H	Syrup
81	"	0	NH	-CH ₂ -	-0-	-CH ₂ -	-OH ₃ -CH ₃	-H	-H	Resin
82	"	0	NH	-CH ₂ -	-NH-	-CH ₂ -	-H	-H	-H	Resin
83	"	0	NH	-CH ₂ -	-N-CH ₃	-CH ₂ -	-H	-H	-H	Syrup
84	"	0	NH	-CH ₂ -	-N-C ₆ H ₅	-CH ₂ -	-H	-H	-H	Resin
85	"	0	NH	-CH ₂ -	-N-C ₆ H ₅ OH ₃	-CH ₂ -	-H	-H	-H	Resin
					0					
					-N-P=O	-CH ₂ -	-H	-H	-H	Glass
F6	"	S	NH	-CH ₂ -	-CH ₂ -CH ₃	-CH ₂ -	-H	-H	-H	Glass
F7	"	S	NH	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	H	Glass
F8	4-Cl-2-F-5-00H ₂ C=O1-C ₆ H ₂	S	NH	-CH ₂ -CH ₃	-CH ₂ -	-CH ₂ -	-CH ₃	-H	-H	Resin

Item No.	Ar	X	Y	Z	W	R ₁	R ₂	R ₃	R ₄ (⁹ C)
89	4-C1-2-F-5-OCH ₃ -C ₆ H ₅	S	NH	-CH ₂ -	-O-	-CH ₂ -	-H	-H	61.0, 71
90	"	S	NH	-CH-CH ₃	-O-	-CH-CH ₃	-H	-H	61.0, 71
91	"	S	NH	-CH ₂ -	-S-	-CH ₂ -	-H	-H	Syrup
92	"	S	NH	-CH ₂ -	-CH-CO ₂ C ₂ H ₅	-CH ₂ -	-H	-H	Syrup
93	"	S	NH	-CH ₂ -	-NH-	-CH ₂ -	-H	-H	Resin
94	"	S	NH	-CH ₂ -	-N-CH ₃	-CH ₂ -	-H	-H	Resin
95	"	S	NH	-CH ₂ -	-NH-	-CH ₂ -	-H	-H	Resin
96	"	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
97	4-Br-2-F-5-OCH ₃ -C ₆ H ₂	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
98	4-Br-2F-5-OCH ₂ C=CH-C ₆ H ₂	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
99	4-C1-2F-5-OCH(CH ₃) ₂ -C ₆ H ₂	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
100	4-C1-2F-5-OCH ₂ C=CH-C ₆ H ₂	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
101	4-Br-5-CO ₂ CH(CH ₃) ₂ -C ₆ H ₂	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
102	4-C1-5-CO ₂ CH(CH ₃)CO ₂ C ₂ H ₅ -C ₆ H ₃	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
103	4-OH-C ₂ H ₅ -3-OCH ₂ C ₂ H ₅ -C ₆ H ₃	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin
104	2,4-F ₂ -5-OCH ₂ OCH ₃ -C ₆ H ₃	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Syrup
105	6-F-C ₂ H ₅ -3-OCH ₂ C ₂ H ₅ -C ₆ H ₃	S	O	-OH-	-OH-	-OH-	-H	-H	Syrup
106	6-OCH ₂ C ₂ H ₅ -3-OCH ₂ CH ₂ CF ₃ -C ₆ H ₃	S	O	-CH ₂ -	-CH ₂ -	-CH ₂ -	-H	-H	Resin

Ecological Examples

The damage to weed plants or the crop plant compatibility was assessed according to a key, in which the effectiveness is expressed by values from 0 - 5. In this:

- 5 0 = no action or damage
- 1 = 0 - 20% action or damage
- 2 = 20 - 40% action or damage
- 3 = 40 - 60% action or damage
- 4 = 60 - 80% action or damage
- 10 5 = 80 - 100% action or damage

1. Pre-emergent action on weeds

Seeds or rhizome pieces of monocotyledonous and dicotyledonous weed plants were placed in sandy loam in plastic pots ($\phi = 9$ cm) and covered with soil. The compounds according to the invention, formulated in the form of wettable powders or emulsion concentrates, were then applied in varying dosages to the surface of the covering soil as aqueous suspensions or emulsions with an applicational amount of water equivalent to 600 - 20 800 l/ha.

After treatment, the pots were placed in a greenhouse and kept under good growth conditions for the weed plants (temperature 23 plus/minus 1°C, relative air humidity 60 - 80%).

25 The optical assessment of the plants or emergence damage in comparison to the untreated controls was carried out after emergence of the test plants after an experimental time of 3 - 4 weeks.

As the assessment values in Table 2 show, the compounds according to the invention have a good herbicidal pre-emergence activity against a broad spectrum of weed

grasses and weeds.

2. Post-emergent action against weeds

5 Seeds or rhizome pieces of monocotyledonous and di-cotyledonous weeds were placed in sandy loam in plastic pots ($\phi = 9$ cm), covered with soil, and germinated in a greenhouse under good growth conditions. The test plants were treated at the three-leaf stage three weeks after sowing.

10 The compounds according to the invention, formulated as wettable powders or as emulsion concentrates, were sprayed onto the green plant parts in various dosages having an applicational amount of water equivalent to 600 l/ha, and the action of the preparations was assessed optically in comparison to untreated controls 15 after the test plants had stood for about 3 - 4 weeks in a greenhouse under optimum growth conditions (temperature 23 plus/minus 1°C, relative air humidity 60 - 80%).

20 The agents according to the invention also have a good post-emergent herbicidal activity against a broad spectrum of economically important weed grasses and weeds (Table 3).

Tabelle 2: Pre-emergent action of the compounds

Example No.	Dose kg of a.i./ha	herbicidal action				
		STM	CRS	SIA	LOM	ECG
2	2.5	5	5	5	5	5
5	2.5	3	4	2	2	4
6	2.5	5	5	5	5	5
7	2.5	5	5	5	5	5
54	2.5	5	5	5	5	5
55	2.5	5	5	5	5	5
63	2.5	5	5	5	5	5
64	2.5	5	5	5	5	5
67	2.5	5	5	5	5	5
68	2.5	5	5	5	5	5

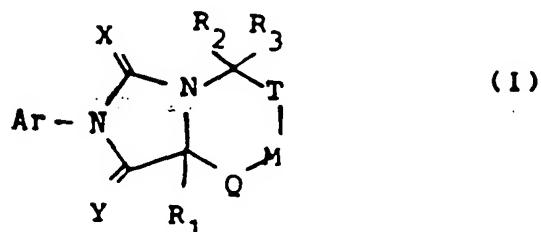
Tabelle 3: Post-emergent action of the compounds

Example	Dose kg of a.i./ha	herbicidal action				
		STM	CRS	SIA	LOM	ECG
2	2.5	5	5	5	5	5
6	2.5	5	4	5	5	5
7	2.5	5	4	5	5	4
54	2.5	5	5	5	5	5
55	2.5	4	3	3	3	4
63	2.5	5	4	5	5	3
64	2.5	4	3	5	4	4
67	2.5	4	5	5	3	3
68	2.5	5	5	5	5	5

Abbreviations

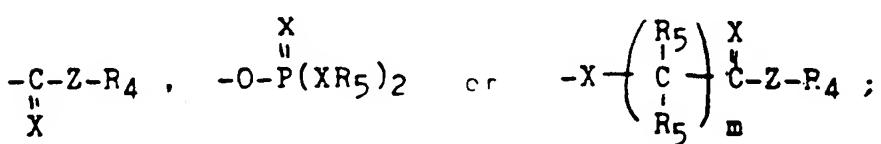
STM = *Stellaria media*
CRS = *Chrysanthemum segetum*
SIA = *Sinapis alba*
LOM = *Lolium multiflorum*
ECG = *Echinochloa crus-galli*
a.i. = active substance

1. A compound of the formula I, or a salt thereof,



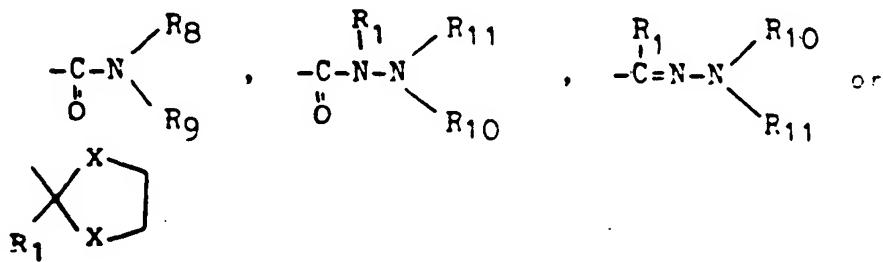
in which

Ar denotes phenyl, naphthyl, pyridyl, quinolinyl or isoquinolinyl, these radicals being monosubstituted to tetrasubstituted, preferably monosubstituted to trisubstituted, by identical or different radicals from the series comprising halogen, hydroxyl, (C₁-C₄)alkyl, halo(C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₃-C₆)-cycloalkoxy, (C₃-C₆)alkenyloxy, (C₃-C₆)alkynyloxy, (C₁-C₄)alkoxy-(C₁-C₄)-alkoxy, halo(C₁-C₄)alkoxy, halo(C₃-C₆)alkenyloxy, halo(C₃-C₆)alkynyloxy, (C₁-C₄)alkylthio, (C₁-C₄)alkylsulfinyl, (C₁-C₄)-alkylsulfonyl, NO₂, -CN, -NHR₁, cyano(C₁-C₄)alkyl, phenoxy, phenoxy(C₁-C₄)alkyl, phenyl(C₁-C₄)alkoxy, phenylthio, phenylsulfinyl or phenylsulfonyl, it being possible for the six lastmentioned radicals to be monosubstituted, disubstituted or trisubstituted in the phenyl ring by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, (C₁-C₄)alkoxycarbonyl, -CN or NO₂, or furthermore by a radical of the formula

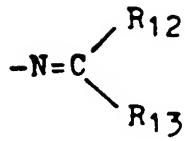


R₁ denotes hydrogen, (C₁-C₄)alkyl or phenyl which may be monosubstituted or disubstituted by halogen, (C₁-C₄)alkyl, (C₁-C₄)alkoxy, NO₂, CN or (C₁-C₄)-alkoxycarbonyl,

R_2 and R_3 , independently of one another, denote hydrogen, (C_1-C_4)alkyl which may be substituted by cyano, hydroxyl or (C_1-C_4)alkoxy, phenyl or benzyl which may both be substituted, in each case preferably monosubstituted or disubstituted, in the phenyl ring by halogen, (C_1-C_4)alkyl, (C_1-C_4)-alkoxy, NO_2 or $-CN$; (C_1-C_4)alkoxy, (C_1-C_4)-alkoxycarbonyl, halo(C_1-C_4)alkoxycarbonyl, (C_1-C_4)-alkoxy(C_1-C_4)-alkoxycarbonyl, (C_1-C_4)-alkoxycarbonyl(C_1-C_4)-alkoxycarbonyl, carboxyl or a radical of the formula



R_4 denotes hydrogen, (C_1-C_4)alkyl which may be monosubstituted to hexasubstituted by halogen and/or monosubstituted or disubstituted by (C_1-C_4)alkoxy, (C_1-C_4)alkoxy(C_1-C_4)alkoxy, (C_1-C_4)alkoxycarbonyl, (C_1-C_4)alkylthio, (C_1-C_4)alkylsulfinyl, (C_1-C_4)-alkylsulfonyl, (C_1-C_4)alkylamino, $-CN$, furyl, tetrahydrofuryl, benzofuryl, phenyl, phenoxy or benzyloxy, it being possible for the six last-mentioned radicals to be monosubstituted to trisubstituted, in each case in the phenyl ring or the heteroaromatic ring, by halogen, (C_1-C_4)alkyl or (C_1-C_4)alkoxy, (C_3-C_6)cycloalkyl, (C_3-C_6)-alkenyl, cyclohexenyl, (C_3-C_6)alkynyl or phenyl, which may be monosubstituted to trisubstituted by halogen, (C_1-C_4)alkyl, (C_1-C_4)alkoxy or (C_1-C_4)alkoxycarbonyl; or a radical of the formula

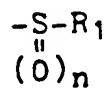
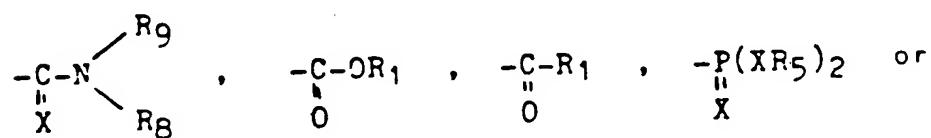


where the lastmentioned radical is excluded when
 $\text{Z} = \text{S}$,

R_5 denotes hydrogen or $(\text{C}_1\text{-}\text{C}_4)$ alkyl,

R_6 denotes hydrogen, $(\text{C}_1\text{-}\text{C}_4)$ alkyl or, together with R_4 and the nitrogen atom connecting these radicals, a 5- to 7-membered heterocyclic ring which can contain as ring members one or two radicals from the series comprising $-\text{O}-$, $-\text{S}-$ and $-\text{NR}_5-$ and which may be monosubstituted to trisubstituted by $(\text{C}_1\text{-}\text{C}_4)$ alkyl;

R_7 denotes hydrogen, $(\text{C}_1\text{-}\text{C}_4)$ alkyl, phenyl or benzyl, where the phenyl ring may in each case be monosubstituted to trisubstituted by halogen, $(\text{C}_1\text{-}\text{C}_4)$ alkyl, $(\text{C}_1\text{-}\text{C}_4)$ alkoxy, $(\text{C}_1\text{-}\text{C}_4)$ alkoxycarbonyl, $-\text{NO}_2$, CF_3 , $-\text{CN}$ or a radical of the formula



R_8 and R_9 , independently of one another, denote hydrogen or (C_1-C_4)alkyl, or the two radicals R_8 and R_9 , together with the nitrogen atom connecting them, denote a 5- to 7-membered heterocyclic ring which can contain as ring members one or two radicals from the series comprising -O-, -S- and -NR₅- and which may be monosubstituted to trisubstituted by (C_1-C_4)alkyl, hydroxyl, (C_1-C_4)alkoxy, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in the phenyl ring by (C_1-C_4)alkyl, (C_1-C_4)alkoxy, halogen or (C_1-C_4)alkoxycarbonyl,

R_{10} and R_{11} , independently of one another, denote hydrogen, (C_1-C_4)alkyl, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in each case in the phenyl ring, by halogen, (C_1-C_4)alkyl, (C_1-C_4)alkoxy, NO₂, -CN, CF₃ or (C_1-C_4)alkoxycarbonyl, or R_{10} and R_{11} together denote the



R_{12} and R_{13} , independently of one another, denote (C_1-C_4)-alkyl, (C_1-C_4)alkoxycarbonyl, phenyl or benzyl which may both be substituted, preferably monosubstituted to trisubstituted, in the phenyl ring by halogen, (C_1-C_4)alkyl, (C_1-C_4)alkoxy, (C_1-C_4)-alkoxycarbonyl, CF₃, -CN or NO₂,

M denotes $=\text{C}^{R_2}$, $-\text{S}^0$, $-\text{S}^0$, $-\text{S}^0$, $-\text{O}^0$ or NR_7^0 ;
 R_3 0

Q denotes $=\text{C}^{R_2}$, $-\text{S}^-$ or $-\text{O}^-$,
 R_3

T denotes $\begin{array}{c} R_2 \\ \diagup \quad \diagdown \\ C \quad \quad \quad \\ \diagdown \quad \diagup \\ R_3 \end{array}$, $-S-$, $\begin{array}{c} O \\ \parallel \\ -S- \end{array}$, $\begin{array}{c} O \\ \parallel \\ -S- \end{array}$ or $-O-$,

X denotes O or S,

Y denotes O, S or NH,

Z denotes O, S or NR_6 ,

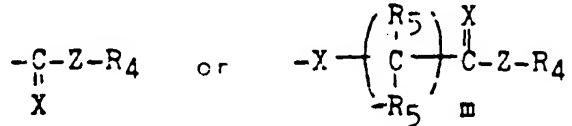
m denotes 1, 2 or 3, and

n denotes 1 or 2,

with the proviso that m cannot be CH_2 , S, SO or SO_2 when Y denotes O, R₁, R₂ and R₃ denote H and Q and T denotes CH_2 .

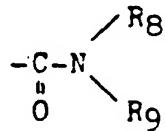
2. A compound of the formula I of claim 1, in which

Ar denotes phenyl, which may be monosubstituted to trisubstituted by fluorine, chlorine, or bromine, (C_1-C_4) alkyl, (C_1-C_4) alkoxy, (C_3-C_4) alkenyloxy, (C_3-C_4) alkynyloxy, halo (C_1-C_4) alkyl, halo (C_1-C_4) alkoxy, $-NHR_1$, (C_1-C_4) alkylthio, (C_1-C_4) alkylsulfonyl, NO_2 or a radical of the formula



R₁ denotes hydrogen, (C_1-C_4) alkyl or (C_1-C_4) alkoxy-carbonyl,

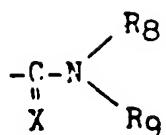
R₂ and R₃, independently of one another, denote hydrogen, (C_1-C_4) alkyl, (C_1-C_4) alkoxycarbonyl, (C_1-C_4) alkoxy (C_1-C_4) alkoxycarbonyl, halo (C_1-C_4) alkoxy-carbonyl, (C_1-C_4) alkoxycarbonyl (C_1-C_4) alkoxy-carbonyl, -CN, carboxyl or



R₄ denotes (C_1-C_4) alkyl, halo (C_1-C_4) alkyl, (C_1-C_4) alkoxyalkyl or (C_1-C_4) alkoxycarbonyl (C_1-C_4) alkyl;

R₅ denotes H or (C_1-C_4) alkyl,

R₇ denotes hydrogen, (C₁-C₄)alkyl,



phenyl or benzyl, which may both be monosubstituted or disubstituted by (C₁-C₄)al'-'l, (C₁-C₄)alkoxy, halogen, NO₂, or -CF₃,

R₈ and R₉ denote hydrogen, (C₁-C₄)alkyl or, together with the nitrogen atom connecting them, a 6-membered saturated heterocyclic ring.

M denotes  , $-O-$ or $-NR_7-$

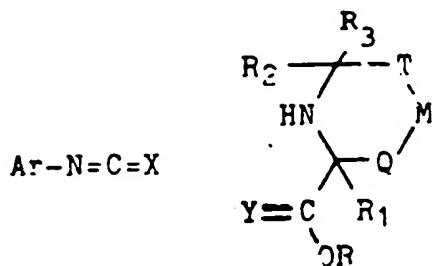
Q denotes 

T denotes  or $-S-$

X denotes O or S,
 Y denotes O or NH,
 Z denotes O or S and
 m denotes 1.

3. A process for the preparation of a compound of the formula I of claim 1 or 2, or a salt thereof, wherein

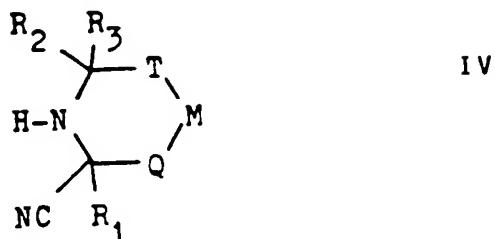
a) where Y = O or S, a compound of the formula II is
reacted with a compound of the formula III



11

I I I

in which R denotes H or (C₁-C₄)alkyl, or
b) a compound of the formula II is reacted with an amine
of the formula IV



or

c) where Y = 0, a compound of the formula I obtained
under b) is hydrolyzed, and the compound obtained is
converted, if appropriate, into its salt.

4. A herbicidal comprising a compound of the formula I of claim 1 or 2, or a salt thereof and an inert carrier.
5. The use of a compound of the formula I of claim 1 or 2, or a salt thereof, as a herbicide.
6. A process for controlling undesired plants, wherein an effective amount of a compound of the formula I, or a salt thereof, of claim 1 or 2 is applied to these plants or to the land used agriculturally.

DATED this 17th day of December 1987.

HOECHST AKTIENGESELLSCHAFT

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